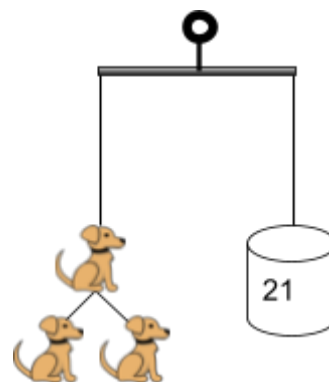


Lesson 2: Making Models

Instead of buying a premade mobile at the gift shop, you can also make your own mobile.

Gabriel wants to make a mobile for his sister. She really likes dogs and so he starts making a mobile that looks like this using a V bar to connect two dogs to the one here.



1. What would an equation be for this hanger?

On each side of the mobile hangs a group of objects. The weight of the objects on each side can be written as an **algebraic expression**. The **variable** in an algebraic expression can represent different numbers or, in this case, weights. When we know the value of a variable we can **evaluate**, or find the total value of, the algebraic expression.

2. In the following expressions, ***d*** represents the weight of the dog. If the weight of the dog is 5 ounces, evaluate the following expressions:

a. $d + d + d + 1$ $d = \underline{\hspace{2cm}}$

b. $3d + 1$ $d = \underline{\hspace{2cm}}$

c. $3(d + 1)$ $d = \underline{\hspace{2cm}}$

d. $3d + 3$ $d = \underline{\hspace{2cm}}$



3. Explain why the values for 2a and 2b were the same even though the expressions look different.



4. Likewise, explain why 2c and 2d had the same value even though the expressions look different.

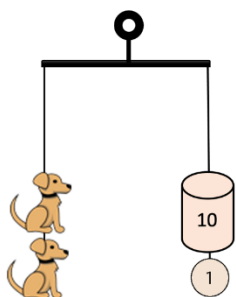
Making Models

Equivalent expressions have the same value. Expressions like $3 + 7$ and $8 + 2$ are equivalent since they are both equal to 10. Equivalent expressions also can be written as equations since they are equal. The equation $3 + 7 = 8 + 2$ is a true statement since $3 + 7$ is the same value as $8 + 2$.

Equivalent algebraic expressions have the same value for any value that you substitute for the variable. An equivalent algebraic expression for $\frac{(d-1)}{2}$ is $\frac{1}{2}(d - 1)$.

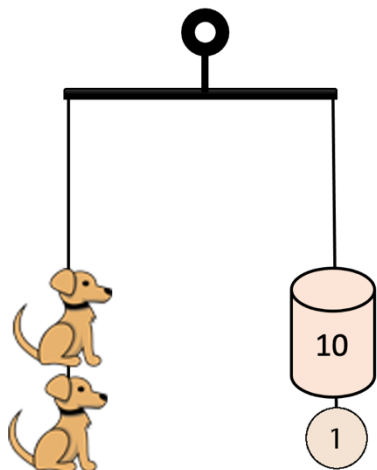


5. Explain why $\frac{1}{2}(d - 1)$ is equivalent to $\frac{d}{2} - \frac{1}{2}$.



If the weights of the objects on either side of the mobile are the same, then the algebraic expressions are **equal (=)**.

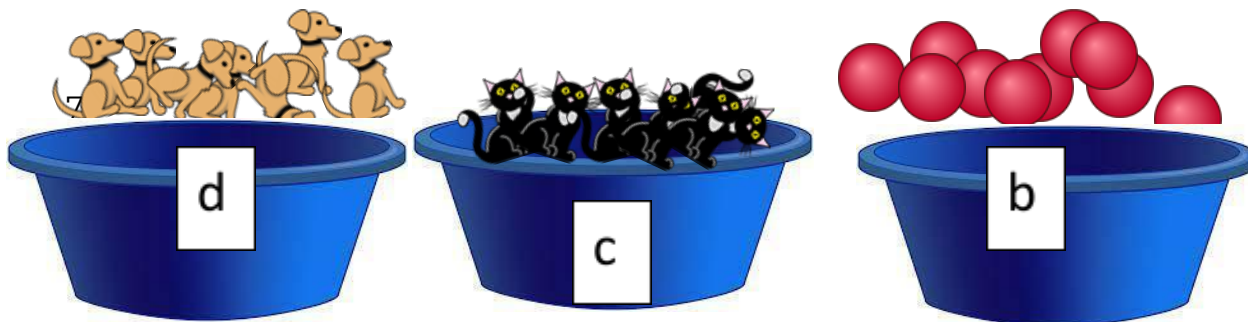
6. Find the weight of the dog using both the hanger model, and the equation that is next to it.



$$d + d = 10 + 1$$

Making Models

The gift shop has tubs with many of the objects used in the hanger models: animals, shapes, coins, and weighted shapes for 1 unit, 5 units and 10 units.



Each mobile that is made should include a label with a code. The shop has tubs with many of the objects used in the hanger models: animals, shapes, coins, and so on. The weight for each object is going to be named using a variable. There are also weighted shapes for

1 unit:

1

5 units:

5

10 units:

10

There is a stack of challenge cards next to the bins.

Two cards have the following codes: $12 = 3c$ and $d + 14 = 20$

7. What would the hanger models look like for these cards?

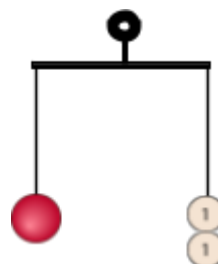
Describe or draw these hanger models using the letters for the object.

Another challenge card shows: $7 = b + 2$

8. Describe or draw this hanger model.
9. Create your own hanger model and matching equation to go with it.

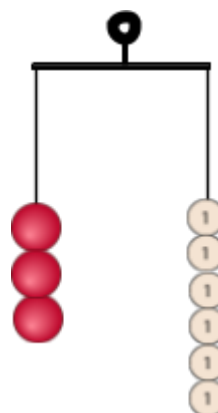
Kayla builds a mobile using the balls from the tub labeled b.
She starts with the following hanger model:

10. What is the code for this hanger model?



She then triples the number of objects on each side.

11. What is the code for the “tripled” hanger model?



Summary

Before we left the gift shop, we evaluated expressions using the value of a variable. We also compared equivalent expressions. Equations are ways to compare algebraic expressions using symbols for equality (=).

Building hanger models is like building equations. We can build hanger models using operations such as multiplication, like when Kayla tripled and quadrupled the objects on each side of the hanger. We can do the same thing with equations. To solve equations built with multiplication, we solve them using the inverse operation – in this case division. Dividing both sides of an equation is like undoing a hanger model built with multiplication.

12. What is the code for Kayla's quadrupled hanger model (shown at right)?

13. Show how you would solve the equation representing Kayla's hanger model.

